Unit 3
Day 1
Section 2.3
Pure Imaginary Numbers and the Powers of i

PURE IMAGINARY NUMBERS

The square of the imaginary unit, which we denote by i , is -1 .

$$i^2 = -1$$

POWERS OF i

$$i^1 = i$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^4 \cdot i = 1 \cdot i = i$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^4 \cdot i = 1 \cdot i = i$$

$$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^4 \cdot i = 1 \cdot i = i$$

$$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$$

$$i^7 = i^4 \cdot i^3 = 1 \cdot -i = -i$$

POWERS OF i

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^4 \cdot i = 1 \cdot i = i$$

$$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$$

$$i^7 = i^4 \cdot i^3 = 1 \cdot -i = -i$$

$$i^8 = i^4 \cdot i^4 = 1 \cdot 1 = 1$$

No need to write this slide in your notes!

POWERS OF i

$i^1 = i$	$i^5 = i$	$i^9 = i$	$i^9 = i^4 \cdot i^4 \cdot i = i$
$i^2 = -1$	$i^6 = -1$	$i^{10} = -1$	$i^{10} = i^4 \cdot i^4 \cdot i^2 = -1$
$i^3 = -i$	$i^7 = -i$	$i^{11} = -i$	
$i^4 = 1$	$i^8 = 1$	$i^{12} = 1$	$i^{12} = i^4 \cdot i^4 \cdot i^4 = 1$

$$i^{11} = i^3 = -i$$

Rule for Divisibility by 4

If the last two digits of a number is divisible by four, then the number is divisible by four.

1. $i^{2049} = i^{1} = i$

2. $i^{3873943} = i^{3} = -i$

3. $i^{-17} = \dfrac{1}{i^{17}} = \dfrac{1}{i} \cdot \dfrac{i}{i} = \dfrac{i}{-1} = -i$

$-1\, i^{-51}$

4. $-i^{-51} = \dfrac{-1}{i^{51}} = \dfrac{-1}{i^{3}} = \dfrac{\cancel{-}1}{\cancel{-}i} \cdot \dfrac{i}{i} = -i$

$$-i^{51} = -(i^3) = -(-i) = i$$

Definition of Equality- for real numbers a,b,c and d, a+bi=c+di iff (if and only if) a=c and b=d.

1. Find the real values of a and b.

$$a - 10i = 7 + 12bi + 8a$$

$-8a$ $\qquad -8a$

$-7a - 10i = 7 + 12bi$

$-7a = 7 \qquad -10i = 12bi$

$a = -1 \qquad -10 = 12b$

$b = -10/12 = \frac{-5}{6}$

$b = -5/6$

2. Find the real values of a and b.

$$8i - 2(a-5) = 2 + 2i(b+4)$$

$\cancel{8i} - 2a + 10 = 2 + 2bi + \cancel{8i}$

$8 + 0i = 2a + 2bi$

$8 = 2a \qquad 0 = 2b$

$4 = a \qquad 0 = b$

Goal $a + bi = c + di$

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